PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Restoration Of Sockeye Salmon Into Palmer Lake

BPA project number: 20123
Contract renewal date (mm/yyyy): ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Salmonsoft

Business acronym (if appropriate)

Proposal contact person or principal investigator:

Name	Jeff Fryer
Mailing Address	5810 SW Idaho
City, ST Zip	Portland, OR, 97221
Phone	503-731-1266
Fax	503-235-4228
Email address	salmonsoft@hotmail.com

NPPC Program Measure Number(s) which this project addresses
8.5F,7,5A.3

FWS/NMFS Biological Opinion Number(s) which this project addresses

Other planning document references
ISG Conclusion 1-2

Short description
Sockeye salmon will be restored to Palmer Lake, Washington, by reprogramming the Cassimer Bar Hatchery.

Target species
Sockeye salmon

Section 2. Sorting and evaluation

Subbasin
Okanogan

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories

☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☒ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Pre-project work	a	Obtain permits
		b	Site net pens
		c	Baseline limnological monitoring
2	Release 82,000 marked parr and 75,000 marked smolt into Palmer Lake	a	Release Cassimer Bar Hatchery parr into net pens
		b	Mark and release net pen parr and smolt into Palmer Lake
		a	Limnological monitoring

3	Determine if parr exit lake and whether Similkameen flooding limits the number of sockeye exiting	a	Install flow meter at outlet of Palmer Lake to determine direction and rate of flow.
		b	Install screw trap on Similkameen River between Palmer Lake and Enloe Dam
		c	Trawl Palmer Lake to determine parr abundance
3	Determine if there are adult returns from this program	a	Monitor returns as part of CRITFC adult sampling at Bonneville Dam and broodstock collection activities at Wells Dam
		b	Conduct spawning ground survey on Similkameen and Okanogan rivers

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	4/2000	12/2000	Pre-project work	Permits obtained	100.00%
2	4/2001	9/2002	Release 164,000 marked parr and smolt into Palmer Lake	Parr and smolt released	0
					0.00%
3	4/2002	7/2003	Determine if parr exit Palmer Lake and whether Similkameen flooding limits the number of sockeye exiting		0.00%
4	6/2001	11/2004	Determine if there are adult returns from this program		0.00%
				Total	100.00%

Schedule constraints

Completion date
3/2005

Section 5. Budget

FY99 project budget (BPA obligated):

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel		%2	2,000
Fringe benefits		%0	

Supplies, materials, non-expendable property		%0	
Operations & maintenance		%0	
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	
NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%0	
Indirect costs		%0	
Subcontractor	CRITFC	%17	17,132
Subcontractor	Colville Tribe	%81	82,328
Other		%0	
TOTAL BPA FY2000 BUDGET REQUEST			$101,460

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Douglas County PUD	Sockeye juvenile production	%69	226000
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$327,460

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$210,000	$180,000	$190,000	$200,000

Section 6. References

Watershed?	Reference
☐	Allen R.L. and T. K. Meekin. 1980. Columbia River sockeye salmon study 1971-1974. Washington Department of Fisheries Progress Report 120.
☐	Fanning, M.L. 1985. Enloe Dam passage project annual report 1984. Prepared for Bonneville Power Administration, Division of Fish and Wildlife, Portland, by IEC Beak Consultants, LDT, Richmond, B.C.
☐	Fish, F.F. and Hanavan, M.G. 1948. A report upon the completion of the Grand Coulee Fish Maintenance Project 1939-1947. United States Fish and Wildlife Service Special Scientific Report Number 55.
☐	Fryer, J.K. 1995. Columbia Basin sockeye salmon. PhD Dissertation. University of Washington, Seattle.
☐	Fulton, L.A. 1970. Spawning areas and abundance of steelhead trout and coho, sockeye, and chum salmon in the Columbia River Basin-past and present. National Marine Fisheries Service Special Scientific Report (Fisheries) 618.
☐	Kyle, G.B. and J.P. Koenings. 1988. Density-dependent, trophic level responses to an introduced run of sockeye salmon (Oncorhynchus nerka) at Frazer Lake, Kodiak Island, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 45:856:867.
☐	Mullan, J.W. 1986. Determinants of sockeye salmon abundance in the Columbia River,

	1880s-1982: a review and synthesis. United States Fish and Wildlife Service Biological Report 86(12).
☐	Okanogan Public Utility District No. 1. 1991. Enloe Hydroelectric Project. Application ofr license to the Federal Energy Regulatory Commission, project 10536. Okanogan, WA.
☐	Oroville-Tonasket Irrigation District. 1991. Oroville-Tonasket Palmer Lake storage project environmental checklist. Oroville, WA.
☐	Pratt, K.L., D.W. Chapman, and M. Hill. 1991. Potential to enhance sockeye salmon upstream from Wells Dam. Don Chapman Consultants, Boise.
☐	Woodey, J.C. 1966. Sockeye salmon spawning grounds and adult returns in the Lake Washington watershed. Masters Thesis, University of Washington, Seattle.

PART II - NARRATIVE

Section 7. Abstract

Both the 1994 Columbia Basin Fish and Wildlife Program and the ISG report, Return to the River, call for the restoring salmonid habitat and access to habitat. The species that lost the largest proportion of habitat in the Columbia Basin is sockeye salmon. Presently, only two of over 25 lakes that may have produced sockeye salmon host significant runs and runs returning to those two lakes (Lake Wenatchee and Osoyoos Lake) have recently been in steep decline. Supplementation programs, involving raising juvenile sockeye salmon in net pens in both lakes, have had little success in reversing this trend. The Osoyoos Lake program has been particularly problematic due to a lack of suitable sites to put the net pens. We propose to change the Osoyoos Lake program to take the first step toward creating a sockeye salmon run in Palmer Lake. This project will take the juveniles destined for Osoyoos Lake and place them in a net pen in Palmer Lake. The parr will be marked and released into Palmer Lake. The program's success will be measured by whether the parr survive and outmigrate Palmer Lake as smolt, and whether adults from this program return to the Columbia River. Juveniles will be monitored in Palmer Lake and in the Similkameen River. Adult returns will be monitored at Bonneville and Wells dams, as well as by spawning ground surveys in the Okanogan and Similkameen Basins.

Section 8. Project description

a. Technical and/or scientific background

Of all species of Columbia Basin salmon, sockeye salmon have suffered the greatest decline since white men settled the region. The number of fish returning has declined by over 99%, from as much as 3.8 million to just over 10,000 fish. The last five years have seen three of the lowest four run sizes on record. The number of lakes with significant sockeye salmon poplations has declined from over 25 to just two (Lake Wenatchee in the Wenatchee subbasin and Osoyoos Lake in the Okanogan subbasin). The run size in both lakes has generally declined since 1992. Osoyoos Lake sockeye salmon have been considered a stock of special concern by Washington Department of Fish and Wildlife. The optimum spawning population for Osoyoos Lake has been set at 45,000 fish.

To increase run sizes, net pen supplementation programs have been established for both Okanogan and Wenatchee sockeye salmon. Results have been disappointing, particularly so for the Okanogan program. A contributing factor in these poor results has been the inability to find a suitable location for net pens. In most years, high water temperatures through most of the lake mean that all juvenile sockeye salmon rear in the northern basin of the lake. However, this basin is located entirely in Canada and the province of British Columbia has thus far prevented location of net pens in this portion of the lake. Therefore, various other strategies have been attempted (placing the netpens in the Osoyoos Lake outlet, raising fish as subyearling outmigrants, and a traditional hatchery program).

We propose to reintroduce sockeye salmon into Palmer Lake, located in the Similkameen drainage, 20 miles upstream of the Similkameen's confluence with the Okanogan River in northern Washington state. There is some dispute as to whether sockeye salmon were native to Palmer Lake (Fryer 1995), although Fulton (1970) and Allen and Meekin (1980) both maintained that there was a sockeye salmon run to Palmer Lake. Fanning (1985) cited native oral histories telling of a salmon run at least as far as Princeton, British Columbia. Kokanee are present in Palmer Lake. A 3 m high waterfall 6 miles upstream of the Okanogan River confluence has been cited as a barrier to fish passage (Okanogan PUD, Oroville Tonasket PUD). A 16 m dam located just upstream of the falls prevents has prevented salmon from migrating upstream since 1916. However the dam is not presently being used for either irrigation or power production; therefore dam removal or providing fish passage are both under active consideration.

One possible problem with reintroducing sockeye salmon into Palmer Lake would be the unique hydraulics present in the area. During the spring, the Similkameen River, rather than draining Palmer Lake, floods into the lake (Pratt et al. 1991). This may make egress of sockeye salmon smolts from the lake difficult. Part of this study requires monitoring of flows in to, and out, of Palmer Lake.

Sockeye salmon supplementation progams have been successfully conducted in numerous locations in the Pacific Northwest. The Grand Coulee Fish Maintenance Program, which trapped sockeye salmon at Rock Island Dam and transported them to Wenatchee and Osoyoos Lakes as well as three hatcheries apparently resulted in a large increase in sockeye salmon runs (Fish and Hanavan 1948, Mullan 1986). Sockeye salmon runs were successfully introduced into Lake Washington (Woodey 1966) and Frzer Lake (Kyle and Koenings 1988).

b. Rationale and significance to Regional Programs

Restoring access to habitat is listed by the Independent Scientific Group as a priority (Conclusion 2). The Fish and Wildlife Program states that studies "should consider reintroduction [of sockeye salmon] into all historical areas (7.5A.3).

c. Relationships to other projects

The proposed project represents a reprogramming of the present Cassimer Bar project, funded by Douglas County Public Utility District. The project will redirect juvenile fish to Palmer Lake. This project will fund additional work necessary for this reprogramming. Adult monitoring activities will be conducted primarily by CRITFC's PSC funded sockeye salmon monitoring program at Bonneville Dam, as well as by the Douglas PUD-funded Cassimer Bar broodstock collection program.

d. Project history (for ongoing projects)

(Replace this text with your response in paragraph form)

e. Proposal objectives

Objective

1.) Pre-project work.

Necessary permits will be obtained to carry out this project. Monthly limnological surveys of Palmer Lake will be conducted from April through September to provide baseline data.

2.) Release 82,000 Marked parr and 75,000 marked smolt into Palmer Lake

As part of the existing Cassimer Bar hatchery program, adult sockeye salmon are trapped at Wells Dam, transported to the hatchery, and spawned. After hatching, half of the juveniles (approximately 82,000) will be raised until approximately April, and then placed in net pens in Palmer Lake. The fish will be maintained in the net pens,

with their release date determined by secondary lake productivity to optimize survival. The remainder, excepting 5,000 fish which will be used to calibrate the smolt trap, will be released into Palmer Lake as yearlings, prior to outmigrating. The goal for this program is to trap 200 adult sockeye salmon at Wells Dam, resulting in 200,000 fertilized eggs, 82,000 outplants into the net pens, and 75,000 fish released as smolts.

3.) **Determine if smolt emigrate from Palmer Lake and whether Similkameen flooding limits the number of sockeye emigrating.**
Smolt emigration from Palmer Lake will be estimated through the use of a screw-type smolt trap to be placed in the Similkameen River upstream of Enloe Dam. The trap will operate from April 1 through July 1 for the years 2001-2003. The trap will be calibrated to give an estimate of the number of fish migrating by the trap. Trawling will be conducted in Palmer Lake in July 2001-2003 to estimate the number of juvenile sockeye remaining in the lake. Flows will be monitored through the use of a flow meter placed at the bridge across Palmer Creek. How many sockeye salmon emigrate will be one of the key findings of this project. It is estimated that at least 40,000 fish will migrate into the Similkameen River.

4.) **Determine if there are adult returns from this program.**
Adult returns will be monitored as part of an existing CRITFC sampling programs at Bonneville Dam. Other monitoring will be done as part of broodstock collection procedures at Wells Dam and Okanogan River spawning ground surveys conducted by Douglas PUD. If 40,000 smolt begin the migration to the ocean, it is hoped that the estimated return to Bonneville Dam will be 400 adult sockeye salmon.

f. Methods

Objective 1: Pre-project work

Task 1.1: Obtain necessary permits and site net pens

The necessary permits will be obtained and potential sites surveyed for placement of net pens.

Task 1.2 Baseline limnological work

Palmer Lake will be monitored monthly for water temperature profiles, dissolved oxygen profiles, and zooplankton samples to to monitor changes subsequent to the introduction of juvenile sockeye salmon.

Objective 2: Release marked parr into Palmer Lake

Task 2.1: Palmer Lake Monitoring.

Palmer Lake will be monitored monthly for water temperature profiles, dissolved oxygen profiles, and zooplankton samples to to monitor changes subsequent to the introduction of juvenile sockeye salmon. These data will be used to program releases that will maximize sockeye salmon survival.

Task 2.2: Site Net Pens

A location for placing net pens will be selected in Palmer Lake. Palmer Lake is much deeper, and located at a higher elevation the southern basin of Osoyoos Lake. Therefore, the high water temperatures

which are such a problem with the present net pen program should not be present at Palmer Lake. Furthermore, much of the land around Palmer Lake is publicly owned, and development is minimal. It should be relatively easy to locate a suitable location for net pens in Palmer Lake

Task 2.3: Obtain fish from Cassimer Bar Hatchery and release into Net Pens

The Cassimer Bar program will continue as it has in the past, except that approximately half of the fry will be transported from the hatchery in mid to late spring and transported to Palmer Lake. A hatchery tank truck will be used to transport the fish. The fish will be put in the net pens and fed regularly until released. The other half of the fry will remain in the hatchery for an additional year, marked, and released to Palmer Lake as pre-smolt just prior to outmigration.

Task 2.4: Mark and release fish into Palmer Lake

Juvenile fish will be adipose clipped (or otherwise marked), and released into Palmer Lake in the fall. Experimental releases may be made earlier in the year and associated with lake productivity parameters such as thermal stratification, zooplankton density, and zooplankton size.

Objective 3: Determine if parr emigrate from Palmer Lake and whether Similkameen River flooding limits the number of sockeye salmon emigrating

Task 3.1: Install and monitor flow at the outlet of Palmer Lake to determine direction and rate of flow

A flow and depth meter will be installed at the outlet to Palmer Lake, probably under the bridge just downstream of the outlet. The flow meter will record both the current velocity and direction of the current (flowing into or out of the lake). Data from this meter will be used to determine the duration and magnitude of inflow events. The data will be correlated with recovery information from a smolt trap located downstream on the Similkameen River to look for velocity barriers to fish passage. Flows will be monitored from April 1 through July 1.

Task 3.2: Install and monitor smolt trap on Similkameen River

A smolt trap will be installed on the Similkameen River between Palmer Lake and Enloe Dam. A likely location for the screw trap will be at the upstream edge of the reservoir behind Enloe Dam. However, if access and safety conditions do not permit the location of the trap at this location, other locations will be considered. The trap will be monitored from April 15 through July 1 for recoveries of sockeye smolt. Five thousand fish from the Cassimer Bar hatchery will be marked with Bismark Brown and used to determine trapping efficiency.

Task 3.3: Trawl Palmer Lake to determine parr abundance

Trawling will be conducted in Palmer Lake in mid-July to estimate the total number of juvenile sockeye salmon which did not outmigrate. This estimate, combined with an estimate of the number of fish passing the screw trap, will be used to determine overwinter survival as well as the percentage of fish which outmigrated.

Objective 4: Determine if there are adult returns from this program

Task 4.1: Monitor returns at Bonneville and Wells Dams

Returning adults from the Palmer Lake program will be identified by externally visible marks. The existing CRITFC sockeye salmon sampling program at Bonneville Dam, and any broodstock

collection activities at Wells Dam, will be used to record the number of marked fish. This will provide an estimate of the number of Palmer Lake fish migrating past the two locations

Task 4.2: Conduct spawning ground survey on Similkameen and Okanogan rivers

Spawning ground surveys are conducted in most years on the Okanogan River spawning grounds. Surveyers will be instructed to look for marks identifying Palmer Lake fish. It is likely that many Palmer Lake fish will likely try to make it back to Palmer Lake, only to be blocked by Enloe Dam. Therefore, spawning ground surveys will also be conducted on the Similkameen River between Enloe Dam and the Okanogan River. Sockeye are often seen spawning in this area at the present time-whether these are Okanogan sockeye or kokanee washed out from Palmer Lake is unknown. If this project is successful, it is hoped that future plans would be made to pass or transport adult migrants around Enloe Dam.

g. Facilities and equipment

Smolt Trap (1): Colville Tribe
Net Pens (2): Colville Tribe
Boat (1): Colville Tribe
Flow and Temp. Monitor: To be purchased
Nets: To be purchased
Vehicle (1) Colville Tribe

h. Budget

The Colville subcontract will be used to reprogram sockeye juvenile production to Palmer Lake. This will include hiring a project biologist to coordinate reprogramming juvenile production. The CRITFC subcontract will fund a portion of the monitoring activities. Other funds will be used to coordinate and administer the project.

Section 9. Key personnel

Chris Fisher, Colville Tribe, project leader
Jeff Fryer, CRITFC and Salmonsoft, limnological study design
Doug Hatch, CRITFC and Salmonsoft, limnological study design

Christopher J. Fisher
P. O. Box 862
Omak, WA 98841
Ph: (509) 422-7427

Education:

University of Georgia	South Dakota State University
School of Forest Resources	Dept. of Wildlife and Fisheries Sciences
B. S. Forest Resources 1990	M. S. Wildlife & Fisheries Science 1996
minor Fisheries management	(Fisheries option)

Experience:

Job title: Anadromous Fisheries Biologist II
Employer: Colville Confederated Tribes, Nespelem, WA 99155

Duties: My duties include the management of anadromous fish stocks for population viability and subsistence for tribal members. I conduct and evaluate creel surveys, analyze catch data and develop regulations. I also participate planning and implementation for watershed restoration projects. I prepare correspondences and reports (monthly, quarterly, annually, and conditionally) needed to maintain good communications within the Tribal organization and Federal, State, and Tribal fishery agencies. I develop budget contract proposals, modifications, and reports as required by Tribal policy or established under contract agreements.

Job title: Fisher biologist
Employer: U.S. Forest Service, Okanogan National Forest (Jan 96 to Mar 97)
U.S. Forest Service, Boisen National Forest (Apr 94 to Nov 95)

Job title: Fishery technician
Employer: Idaho Department of Fish and Game, McCall (Jun 90 to Nov 91)

Job title: Research technician
Employer: School of Forest Resources, University of Georgia (Apr 88 to Sep 89)

Expertise:

By acquiring my education in the southwest and midwest and being employed by both state and federal agencies in three different regions of the country my experience in fisheries is extensive and diverse. My wide range of experience has provided me with expertise in collecting, analyzing and interpreting a variety of data and the ability to communicate the results of management activities and research to professional and civic groups via technical reports or presentations.

Vita of

Jeffrey K. Fryer

Education

1995 University of Washington. Ph.D. (Fisheries).

1985 University of New Brunswick at Fredericton, New Brunswick, Canada. MSc(Computer Science).

1979 University of New Brunswick at Fredericton. BSc(Computer Science) with the equivalent of an Honors in Statistics.

Publications

Fryer, J.K. 1998. Frequency of pinniped-scars and wounds on adult spring-summer chinook and sockeye salmon returning to Bonneville Dam. North American Journal of Fisheries Management. 18:46-51.

Fryer, J.K. 1995. Columbia Basin sockeye salmon-causes of their past decline, factors contributing to their present low abundance, and the future outlook. Ph.D. Thesis. University of Washington, Seattle.

Fryer, J.K. and P.R. Mundy. 1993. Determining the relative importance of survival rates at different life history stages on the time required to double adult salmon populations, p. 219-223. *In* R. J. Gibson and R.E. Cutting [ed.] Production of juvenile Atlantic salmon, *Salmo salar*, in natural waters. Canadian Special Publication in Fisheries and Aquatic Sciences 118.

Hatch, D.R., J.K. Fryer, M. Schwartzberg, and D.R. Pederson. 1998. A computerized editing system for video monitoring of fish passage. North American Journal of Fisheries Management. 18:694-699.

Schwartzberg, M. and J.K. Fryer. 1993. Identification of hatchery and naturally spawning Columbia Basin spring chinook salmon using scale pattern analyses. North American Journal of Fish Management. 13: 263-261.

Employment

October 1989 to present: Fisheries scientist at Columbia River Inter-Tribal Fish Commission. Duties have included participating in Phase II of the Snake River Temperature Project, being responsible for data management and participating in statistical analyses and the writing of the final report. I have also supervised CRITFC's stock identification projects, which has required designing and implementing stock identification experiments, field sampling, creating computer programs, spreadsheets, and databases to manage and analyze data, and publishing technical reports and journal articles.

September 1985 to September 1989: Graduate research and teaching assistant at the University of Washington. Duties included teaching an introductory computer course and assisting the teaching of statistics courses and calculus.

Section 10. Information/technology transfer

The progress and success of this project will be documented in annual reports or journal articles. If this project is successful, it is hoped that knowledge gained can be used to maintain a sockeye run in Palmer Lake, as well as in the reintroduction of sockeye salmon into Skaha or Okanagan lakes.

Congratulations!